1. PROJECT DESCRIPTION

The Bigfork Stormwater Project entails the collaborative efforts of the community of Bigfork and governing body of Flathead County to preserve, protect, and improve the watersheds that contribute to the impaired water body of Flathead Lake. The project involves multiple watersheds; with each watershed containing both localized flooding problems and contributories of pollutants to the downstream receiving waters.

The current project is referenced as Phase IV of the Bigfork Stormwater Project and consists of stormwater construction improvements within Bridge Street. The Bridge Street Project area is divided by the Swan River and is developed into two parts, Bridge Street North and Bridge Street South. Bridge Street (North and South) is primarily located within Township 27N, Range 20W, Section 36, Flathead County, Montana.

Bridge Street North Watershed: This watershed is comprised of thirteen basins and equates to 3.0 acres. Development in this watershed consists of the Bridge Street North Development Phase and is scheduled for construction in 2015; however, the identified construction date is dependent on funding. This watershed discharges to the Swan River via an existing outfall pipe.

Bridge Street South Watershed: This watershed is comprised of sixteen basins and equates to 10.86 acres. Development in this watershed consists of the Bridge Street South Development Phase and is scheduled for construction in the fall of 2015; however, the identified construction date is dependent on funding. This watershed discharges to the Swan River via an existing outfall pipe.

2. PROJECT PURPOSE

The primary purpose of the Bigfork Stormwater Project is to develop successful stormwater management strategies and implement systems that both reduce the potential for flooding and result in the reduction of non-point source nutrient and sediment loading in Flathead Lake. As the community has continued to develop over the years, impervious surface runoff has increased. Stormwater flowing past undersized, or non-existent conveyance pipes has resulted in residential and business flooding and erosion. Nutrients, pollutants, animal waste and household toxins such as automobile fluids, fertilizer and pesticides washed down by runoff are being delivered directly into the Swan River and Bigfork Bay.

The desired outcome of this project is the development, construction and demonstration of a successful urban nutrient and sediment reduction project consistent with load reductions identified in the Nutrient Management Plan and TMDL for Flathead Lake. Quantifiable outcomes for the project will be obtained in two primary facets: (1) Tangible results from the placement or replacement of inlet structures, conveyance pipes, hydrodynamic devices, and cartridge filtration devices. (2) Qualitative results from a series of hydrodynamic and filtration systems that remove pollutants, TSS, phosphorus, nitrogen, bacteria, heavy metals, and hydrocarbons.

3. PROJECT DATA

Basin Characteristics

Impervious surfaces generally produce runoff immediately after precipitation events, and these surfaces represent the limit of contributing areas when modeling runoff focused on water quality and the frequent small precipitation events that dominate annual weather patterns. Pervious surfaces generally produce runoff after initial saturation in approximately 2-year precipitation events or larger, and these surfaces represent the limit of contributing areas when modeling runoff focused on major flood conveyance and the infrequent large precipitation events that occur rarely in annual weather patterns.

Basins within the current development study area were first categorized into connected impervious areas comprising the areas of lowest elevation, or the watershed receiving channel primarily following the Bridge Street North and Bridge Street South roadways. Remaining basins were secondarily categorized into adjacent upstream pervious areas comprising the contributing areas of highest elevation or the watershed headwaters. All basins were delineated by topography and runoff flow direction to a point of downstream inlet or a boundary with an adjacent receiving basin.

Precipitation Events

- **100-year Event** This is the largest magnitude storm event considered. Statistically defined as an event with a 1 in 100 (1%) probability of occurring annually, precipitation depth equals 3.14 inches in 24 hours as determined from NOAA Atlas 2 in GIS compatible format. Greater potential for major flooding and structural damage exists. Stormwater management infrastructure for this project will be designed to direct this level of storm away from structures and properties sensitive to damage.

- **10-year Event** Statistically defined as an event with a 1 in 10 (10%) probability of occurring annually, precipitation depth equals 2.16 inches in 24 hours as determined from interpolating values from NOAA Atlas 2 in GIS compatible format. A minor potential for flooding and inconveniences exists. Typically, natural channels will contain this event at top-of-bank levels.

- **2-year Event** Statistically defined as an event with a 1 in 2 (50%) probability of occurring annually, precipitation depth equals 1.47 inches in 24 hours as determined from NOAA Atlas 2 in GIS compatible format. In a typical year, the project area receives almost all of its rainfall at this storm magnitude or smaller. Furthermore, many pervious surfaces only produce runoff after initial saturation in 2-year and larger events.

- **Water Quality (WQ) Event** This storm event is the precipitation depth equaling 1.19 inches that represents 85.2% of annual runoff volume expected in a typical year. The treatment facilities are sized according to the peak flow rate resulting from the WQ Event, and the net treatment capability of each facility is determined by multiplying the WQ event runoff volume (85.2%) by the treatment percentage of the facility.

Conveyance Improvements

The proposed improvements have been designed to protect developed properties and convey the 100-year storm from drainage inlet areas to discharge points at the Bridge Street North and Bridge Street South Outfalls. The installation of a collection and conveyance system would entail placing a network of catch basins and conveyance pipes near the upper reaches of the watershed and continuing along the Bridge Street right of way to the outfall locations along the Swan River. The collection system is comprised of strategically placed catch basins located in pivotal locations that optimize the ability of capturing surface flows. The catch basins are connected to a network of pipes that vary in size from 8-24 inch in size and have the capability of conveying the 100-year storm event peak flows. Prior to the outlet discharge locations the flow within the pipes would be first routed to a stormwater treatment system.

Water Quality Improvements

The overriding water quality goal for the Bigfork Stormwater Project is to reduce pollutant discharge to Flathead Lake. The numeric limits of the pollutant concentrations specified in Montana DEQ Circular 7 and the Phase I TMDL for Flathead Lake are established by law as the water quality performance objectives for surface and ground water. The Montana Phase II NPDES General Permit Number MTR040000 for Stormwater Discharge Associated with Small Municipal Separate Storm Sewer System (MS4) are established as the voluntary water quality performance objectives for stormwater discharge. Stormwater engineering design for Bigfork has incorporated infrastructure management measures to achieve the established MS4 water quality performance objectives.

The first improvements to water quality in runoff discharges to the Swan River will include replacement of existing pipe and junction structures and the installation of new pipe and catch basins in locations that previously lacked a stormwater system. Existing systems are no longer functioning as intended and have accumulated significant deposits of sediment and other adsorbed pollutants over the years. Video inspection of the pre-construction stormwater system condition confirmed the presence of sediment and debris in the existing pipe and manholes. Installation of new catch basins with sumps will create a system with a large capacity for retained sediment and provide convenient maintenance locations for removal of collected sediment. The positive effect and improvement to pollutant discharge by installing new catch basins and pipe is expected to be significant.

A second improvement to water quality in stormwater runoff on both the north and south side will result from the Total Suspended Solids (TSS) removal capabilities of a commercial hydrodynamic separator. This unit functions low in the watershed by collecting pipe flows containing first-flush contaminants and allows for TSS removal in the settling chambers, adsorbed pollutant removal, and storage until physical sediment removal is performed. This unit also performs the function of pre-treatment for downstream cartridge facilities, which ultimately decreases the maintenance frequency and increases the life expectancy of the cartridges. Large precipitation events exceeding treatment rates are designed to internally bypass the hydrodynamic separator without re-

suspension of stored particles in subsequent storm events. Performance claims from the manufacturer state removal of up to 94% of coarse sand, 81% of fine sand down to 20 microns, spilled oils, and other adsorbed pollutants.

A third improvement to water quality in stormwater runoff will result from the TSS removal capabilities of a commercial cartridge filtration facility. This unit functions low in the watershed by collecting pipe flows containing first-flush and pre-treated contaminants and provides TSS removal in the settling chambers, TSS removal through filters, adsorbed pollutant removal, automated self-cleaning filters, and storage until physical sediment removal. Flows are diverted to this unit through an upstream diversion catch basin, and large precipitation events exceeding system flow rates are designed to bypass externally to the discharge point. Performance claims from the manufacturer are expected to remove up to 86% of fine sands and silts down to 4 microns, 50% of particulate phosphorus, and other absorbed pollutants.

4. PROPOSED WORK PER THE RSID

Phase IV: Bridge Street South
Improvements will remove limited conveyance piping and install new conveyance pipe extending from station 1+50 to 11+00 along the Bridge Street South alignment. These extensions will increase inlet capacity distributed through the impervious areas, provide more efficient collection of runoff from remote pervious areas, and allow for a connection of stormwater system networks. In order to more efficiently improve the surface runoff along Bridge South, portion of the road are going to be constructed to direct flows to proposed curb and gutters that will parallel the road. Runoff from both impervious and pervious areas up to the 100-year event will be collected and piped to the discharge point into the Swan River at the Bridge Street South Outfall. Smaller and frequent runoff events will be treated for pollutant removal in treatment facilities located within the Bridge Street right of way, while larger infrequent runoff events will bypass these treatment facilities to the discharge point.

Runoff conveyed to the discharge point will receive treatment through a commercial hydrodynamic separator unit and a commercial cartridge unit prior to discharge into Swan River at the Bridge Street South outfall. The hydrodynamic separator is oriented immediately upstream to the cartridge unit, and is sized for the purpose of extending the maintenance interval on the cartridge unit. The cartridge unit is oriented at end-of-pipe within the Bridge Street right of way, and is sized for treating 100% of the peak flow rate resulting from the WQ event.

Phase IV: Bridge Street North
Improvements will remove and replace existing conveyance pipe extending from station 1+25 to 9+00 along the Bridge Street North alignment. These extensions will increase inlet capacity distributed through the impervious areas, provide more efficient collection of runoff from remote pervious areas, and allow for a connection of stormwater system networks. Runoff from both impervious and pervious areas up to the 100-year event will

be collected and piped to the discharge point into the Swan River at the Bridge Street North Outfall. Smaller and frequent runoff events will be treated for pollutant removal in treatment facilities located within the Bridge Street right of way, while larger infrequent runoff events will bypass these treatment facilities to the discharge point.

Runoff conveyed to the discharge point will receive treatment through a commercial hydrodynamic separator unit and a commercial cartridge unit prior to discharge into Swan River at the Bridge Street North outfall. The hydrodynamic separator is oriented immediately upstream to the cartridge unit, and is sized for the purpose of extending the maintenance interval on the cartridge unit. The cartridge unit is oriented at end-of-pipe within the Bridge Street right of way, and is sized for treating 100% of the peak flow rate resulting from the WQ event.

5. MAINTENANCE

The overall Bigfork Stormwater Project has been a phased infrastructure improvement project. Phases I-III were completed in 2011 and include upgraded conveyance piping and treatment systems for Grand Drive, Electric Avenue North and River Street in Bigfork Village. Phase IV consist of construction stormwater improvements as it relates to Bridge Street (North & South).

The Flathead County Public Works Department, is responsible for maintenance of the stormwater collection and conveyance system, including catch basins and manholes, pipes, ditches, and stormwater management/treatment facilities. Maintenance activities focus on removing sediment, debris, and pollutants from the stormwater system, before they can be flushed downstream into receiving waters, resulting in adverse effects on aquatic life and water quality. Regular maintenance is needed to keep stormwater management facilities functioning as they were designed. Maintenance for the stormwater collection and conveyance system and water quality units consists of inspection, cleaning, and replacement of filter cartridges. It is important to understand that maintenance only relates to keeping the stormwater system functioning at an optimal level. It does not entail cost affiliated with repairing or replacing portions of the system from damage by others or as the system eventually deteriorates over time.

Phase I

Improvements entailed the installation of catch basins and conveyance pipes in Grand Drive and extending the system up to the intersection with Electric Avenue. Additional improvement added treatment capabilities for runoff generated from the impervious areas up to the WQ event flow rates. Runoff from basins with more potential for concentrated or persistent pollutants are first treated with commercial bioretention units distributed throughout the upstream elevations in the impervious areas. Runoff conveyed to the discharge point then receives additional treatment through a commercial hydrodynamic separator unit and a commercial cartridge filtration unit prior to discharge into Bigfork Bay at the Grand Drive Outfall.

PHASE I (Installed In 2011)	
UNITS	QUANTITY
Precast Catch Basins	27
Filterra Bioretention Filter	4
Stormceptor-STC 900	1
Jellyfish-JF10	1

Phase II

Improvements entailed abandoning the existing stormwater system in north Electric Avenue and rerouting new conveyance pipe to a connection point in the Grand Drive Development Phase. Runoff from the impervious areas of north Electric Avenue are collected and piped to the Grand Drive Outfall where it is treated for pollutant removal by the commercial hydrodynamic separator and commercial cartridge filtration unit installed during the Grand Drive Phase.

PHASE II (Installed In 2011)	
UNITS	QUANTITY
Precast Catch Basins	8

Phase III

An additional improvement was made to add treatment capability to the existing River Street outfall for runoff collected in the River Street Alley located west of north Electric Avenue. A commercial hydrodynamic separator located at the bottom of the alley now treats stormwater for pollutants prior to discharge into Bigfork Bay at the River Street Outfall.

PHASE III (Installed In 2011)	
UNITS	QUANTITY
Precast Catch Basins	3
Stormceptor-STC 450	1

Phase IV

Consist of all the proposed improvements for Bridge Street (North and South) as defined in Section 4 (Proposed Work Per The RSID) of this report.

PHASE IV (Proposed for 2015)	
UNITS	QUANTITY
Precast Catch Basins	32
Stormceptor-STC 900	2
Jellyfish-JF8	2